

3 BOTSWANA



3.1 Summary of Coal Industry

3.1.1 ROLE OF COAL IN BOTSWANA

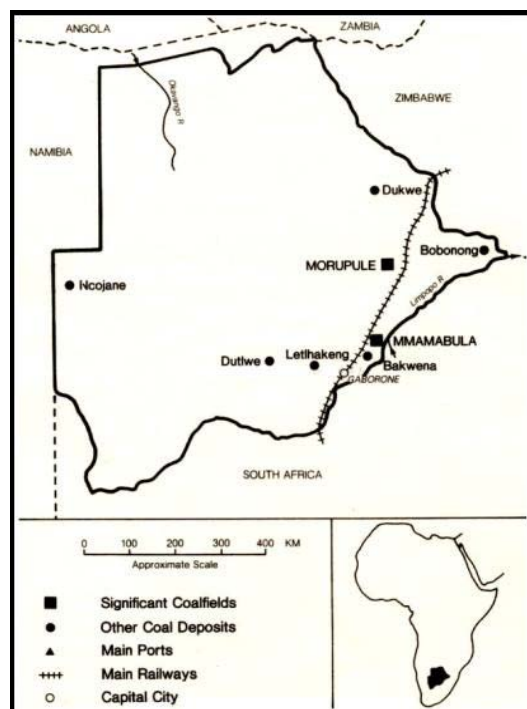
Botswana possesses huge coal resources estimated at greater than 200 billion tonnes. However, only three to five billion tonnes can be economically mined (Mmegi, 2009). The quality of coal in these deposits is suitable for power generation and is the feedstock for 99.4 percent of electricity generated (eStandards Forum, 2009). Table 3-1 quantifies total recoverable reserves and recent coal production in Botswana.

Table 3-1. Botswana's Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank (# and %)
Estimated Proved Coal Reserves (2007)*	40	0	40	54 (0.005 %)
Annual Coal Production (2007)**	1.0	0	1.0	45 (0.02%)

Source: *WEC (2009); **EIA (2010)

Figure 3-1. Botswana Coalfields Map



Source: IEA Coal Research (1983)

In 2007, coal represented 36.2 percent of Botswana's total primary energy supply (IEA, 2009). At present, all coal mined is used domestically for power production, but studies are under way to explore the possible exportation of coal mined at the Morupule mine, the country's only operating mine (Mining Journal, 2005).

The Morupule Mine is located in the Morupule coalfield near the town of Serowe (Figure 3-1) and is the most thoroughly explored of Botswana's fields. The only other major coal field to be explored in some detail is Mmamabula, situated about 81 miles south of Morupule (IEA, 2010).

3.1.2 STAKEHOLDERS

Table 3-2 identifies potential key stakeholders in Botswana's coal mine methane (CMM) and coalbed methane (CBM) development.

Table 3-2. Key Stakeholders in Botswana's CMM Industry

Stakeholder Category	Stakeholder	Role
Developers	<ul style="list-style-type: none"> ▪ Kalahari Energy ▪ TLOU ▪ Anglo Coal Botswana ▪ SAFGAS ▪ Many other small developers ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Project opportunity
Engineering, Consultancy and Related Services	<ul style="list-style-type: none"> ▪ Scales & Associates ▪ Advanced Resources International (ARI) ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Technical assistance
Government and Research Organizations	<ul style="list-style-type: none"> ▪ Botswana Ministry of Minerals, Energy, and Water Affairs ▪ Botswana Geologic Survey ▪ Botswana Power Corporation ▪ Botswana Gas Corporation. 	Regulatory

3.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

There is only one operating coal mine in Botswana, the Morupule Mine, which is 93 percent owned by Debswana (a joint venture of DeBeers and the Government of Botswana) and supplies coal to Botswana's only coal-fired power station. Production from the mine is relatively stable (0.8–1 million tonnes [Mmt] per year) as it is essentially a captive mine for the Morupule Power Station. The mine also supplies coal to hard rock mining operations at Selebi-Phikwe and to the Sua Pan soda ash plant, and coal is exported to Zimbabwe, Zambia and the Democratic Republic of the Congo.

Debswana announced plans to increase coal production at the Morupule Mine to 3.4 Mmt a year to accommodate Botswana Power Corporation's (BPC) plans to add four 150-megawatts (MW) coal-fired power stations alongside the existing four 33-MW units currently at Morupule (eStandards Forum, 2009). CIC Energy is also proposing to develop the Mmamabula Energy Project, which involves a 1,200-MW power station and integrated coal mine planned to provide power mainly to South Africa (CIC, 2010).

3.2 Overview of CMM Emissions and Development Potential

The Global Methane Initiative (formerly Methane to Markets Partnership) International CMM Projects Database currently identifies no CMM recovery projects for Botswana, in operation or development (M2M Projects, 2008).

3.2.1 CMM EMISSIONS FROM OPERATING MINES

Botswana has no reported CMM emissions from active mines. Activity to date has been limited to CBM operations because of the absence of deep, gassy mines in the country.

3.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

There are no reported emissions from abandoned mines in Botswana.

3.2.3 CBM FROM VIRGIN COAL SEAMS

A CBM feasibility study conducted for Botswana Department of Geological Study estimated that Botswana contains about 5.6 trillion cubic meters (Tcm) of CBM reserves in the Central Kalahari Karoo Basin (ARI, 2003). However, these estimates are tenuous as they were derived from only a few core holes drilled into the coals of the basin. Recoverable reserves are estimated at 1.7 Tcm with some of the most prospective areas being found in the eastern portions of the basin (ARI, 2008).

Over the past few years, there has been a tremendous increase in interest in developing CBM projects in Botswana. The Department of Geological Survey (DGS) reported a 50 percent increase in the number of exploration licenses issued between January and December 2009 for various energy minerals, which includes coal and CBM (UGC, 2010). This interest is being driven by the favorable investment climate in Botswana, coupled with an increasingly dire power situation in the region. However, out of more than 50 companies who have taken out CBM leases in the country, very few carried out any substantial resource assessment work to date.

The main companies to have carried out significant CBM exploration activity in Botswana are Kalahari Energy, Anglo Coal Botswana and Saber Energy Corporation. Kalahari Energy (KE) has been actively pursuing CBM development since 2000, and in 2008 drilled a five-well pilot program which is currently in the production testing phase. This was financed with a U.S. Overseas Private Investment Corp \$8.5 million investment guarantee for the purchase of equipment and the drilling of wells. In 2009, KE formed a joint venture with Exxaro Resources to perform ongoing exploration work and is on track to complete a five-well production test in late 2010 (KE, 2010).

Anglo Coal Botswana has embarked on a major CBM exploration drive, started in late 2008, with the aim of delineating gas reserves totaling at least 110 billion m³ (Bcm), sufficient to justify construction of a dedicated synfuels plant. The company holds 47 CBM prospecting licenses in north and central Botswana and exploration activities are ongoing. All projects are at the early reconnaissance phase which involves continuous acquisition of geological information and drilling, to build a regional geological model of the areas and assess the CBM potential (Ryan, 2009). Saber Energy has drilled more than 80 exploratory holes on their lease areas since 2008 to test coal gas content and permeability.

3.3 Opportunities and Challenges to Greater CMM Recovery and Use

Botswana, a non-Annex I country, has signed and ratified the UNFCCC and Kyoto Protocol as shown in Table 3-3.

Table 3-3. Botswana's Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 12, 1992	April 27, 1994
Kyoto Protocol		August 8, 2003

3.3.1 MARKET AND INFRASTRUCTURE FACTORS

It is doubtful whether Botswana will have significant CMM emissions in the foreseeable future. This is because there are abundant reserves of coal at relatively shallow depths and the overall demand for coal in the country is limited. Currently, the prospects for exporting coal are not good, given the distances to available ports in South Africa and limited rail infrastructure. However, in cooperation with the government of Namibia, Botswana is considering the construction of a \$6 billion, 1,500-mile rail link between the Mmamabula Coalfields of southeastern Botswana to either the ports of Walvis Bay or Luderitz in Namibia (Mmegi, 2009).

Since there is negligible domestic demand and support infrastructure for natural gas, the market for methane in Botswana is fairly limited currently (EIA, 2007).

However, CBM projects may see increased attention thanks to a report titled, *Botswana Technology Needs Assessment on Climate Change*, jointly produced by several Ministries and the UN Development Programme. The report acknowledges Botswana's CBM reserve potential, and advises that Botswana determine such resource potential. CBM, it concludes, may be used to provide fuel for cars and power generation, and alleviate potential power crises. CBM may also be exported to Mozambique through the Maputo pipeline and to the Secunda Sasol Plant in South Africa (TNA, 2004).

3.3.2 REGULATORY INFORMATION

As there are no existing CMM projects, a legal framework regulating them does not exist at present.

3.4 Profiles of Individual Mines

Morupule

Morupule is the only active mine in the country. It is located along the eastern margin of the Kalahari Basin. Production began in 1973, and the mine has a production capacity of 1 Mmt per year.

General Information

Total mineable reserves (thousand tonnes)	44,000
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General Geologic Information

Coal seams (thickness)	Morupule Main (6.5–9.5 meters [m]) Lotsane (0.6–4.5 m) Serowe Bright (average 1.8 m)
Faults	Minor. Some dolerite dyke intrusives

Geologic and Mining Conditions

Ash content, % (coal in place, run of mine)	40–50%
Moisture, % (coal in place, run of mine)	5–10%

Coal Production, Methane Emissions, and Degasification (and Use) Statistics

	2000	2001	2002	2003	2004	2005	2006
Coal Production (million tonnes)*	0.95	0.95	0.96	0.81	0.9	0.99	1
Degasification	None	None	None	None	None	None	None

Source: *SGU (2009)

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